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REGIONAL COOPERATION IN THE ECONOMIC AND SOCIAL SPHERES AND RELATED AREAS

Project for a Europe-Africa permanent link through the Strait of Gibraltar

Note by the Secretary-General

1. The Secretary-General has the honour to transmit to the Economic and Social Council the report prepared in accordance with Council resolution 1993/60 by the Executive Secretaries of the Economic Commission for Europe and the Economic Commission for Africa on the work that has been done in connection with the project to establish a Europe-Africa permanent link through the Strait of Gibraltar.

2. The Economic and Social Council has taken an interest in this project since 1982 following a decision by the Governments of Morocco and Spain to carry out joint studies on the feasibility of the project as part of an agreement on bilateral cooperation adopted on 24 October 1980. Since then the Council has regularly requested the two regional commissions to keep track of the progress of studies relating to the project and to inform the Council of any developments.

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ANNEX

Project for a Europe-Africa permanent link through the Strait of Gibraltar: report on studies and activities carried out during the period 1993-1994

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INTRODUCTION

1. In its resolution 1993/60 of 30 July 1993, the Economic and Social Council, inter alia, requested the Executive Secretaries of the Economic Commission for Africa and the Economic Commission for Europe to take an active part in the follow-up to the project for a Europe-Africa permanent link through the Strait of Gibraltar and to report thereon to the Council at its substantive session of 1995.

2. This report is a response to that request. It was drawn up jointly by the two regional commissions and gives a brief overview of the main findings of the studies carried out in 1993-1994 with a view to advancing the project. It also takes account of the conclusions of the special symposium on the project which was organized under the auspices of the Economic Commission for Europe and the Economic Commission for Africa by the International Tunnelling Association (ITA) as part of its Annual General Assembly, held in Cairo on 5 April 1994.

I. GENERAL CONTEXT OF STUDIES

3. It should be recalled that studies designed to advance the project have been carried out jointly by the Governments of Morocco and Spain since 24 October 1980, the date on which the two Governments adopted a bilateral agreement on the subject. This agreement, which formally establishes both Governments' commitment to make a joint study of the feasibility of the project, stipulates the creation of a standing intergovernmental Joint Committee which was to be responsible for carrying out the agreement, and two State companies, one in Morocco and the other in Spain, which were to be responsible for conducting the studies. These companies, which have been working alongside the Joint Committee since 1981, are, on the Spanish side, Sociedad de Estudios para la Comunicación Fija a través del Estrecho de Gibraltar (SECEG), which has its head office in Madrid, and on the Moroccan side, Société Nationale d'Etudes du Détroit (SNED), whose head office is in Rabat. The studies are carried out either by the two research companies directly, or through scientific institutions from both countries or national or international firms of consultants and surveyors with whom the companies have concluded agreements or contracts for services.

4. Within the institutional framework mentioned above, which was later strengthened by a Supplementary Agreement of 27 September 1989 complementing and amplifying the previous agreement, the two companies have conducted their programmes of work in several phases. The findings of the feasibility studies currently in progress (1991-1995) will provide both Governments with information on the feasibility of the permanent link viewed in the context of the long-term development of the straits corridor while at the same time making them aware of relevant proposals concerning future programmes which have some bearing on the development of the project.

II. EVALUATION OF STUDIES CARRIED OUT BETWEEN 1982 and 1992

5. It should also be recalled that the studies carried out between 1982 and 1992 were the subject of an evaluation report in 1993 (E/1993/80) pursuant to Economic and Social Council resolution 1991/74 of 26 July 1991. This report was prepared by the two regional commissions on the basis of evaluations made by a number of international experts.

6. According to the evaluation report, the studies carried out between 1982 and 1992 enabled substantial progress to be made in coming to grips with the key aspects of this major project, touching as they did on the physical environment, engineering options and socio-economic evaluations. These studies made it possible, inter alia, to state with a reasonable degree of certainty that no major geological obstacle existed to the construction of a permanent link through the Strait of Gibraltar, regardless of whether the link was a tunnel bored under the sea or a bridge constructed on fixed supports. The studies also made it possible to identify two potential routes, the shallower or so-called "sill route" along which a tunnel or a bridge could be contemplated, and the shorter or so-called "strait route" along which only a bridge would be possible. In other respects, the studies contributed to solid progress in clarifying the respective engineering options in each case. They also highlighted the socio-economic impact of the project on countries other than Spain and Morocco, and hence the multilateral nature of the project.

7. The evaluation report on the studies carried out between 1982 and 1992 also indicated that further research was necessary in certain areas, and a number of recommendations were formulated with that in mind. With reference to the most significant of these, and considering the sheer scale of the project, it was thought indispensable to obtain greater in-depth knowledge of the geology of the submerged part of the strait, particularly in the context of the tunnel option. To achieve this goal, the evaluation report stated that the ideal solution would be to drill a narrow-bore reconnaissance gallery along the entire course decided on for the tunnel. Without such a gallery, it was deemed necessary to conduct offshore geotechnical experimentation and drilling operations. Regarding economic studies, the evaluation report recommended, for example, that a more thorough assessment should be made of the impact of the permanent link at the local and regional level and that the technical, economic and financial feasibility of a partial implementation of the project should be studied.

III. STUDIES CONDUCTED DURING 1993-1994

8. The observations and recommendations made in the evaluation report on the studies carried out between 1982 and 1992 were noted by the companies responsible for undertaking them and adjustments were made to their work programmes as a result. The studies conducted during 1993-1994 therefore sought to expand knowledge in the areas where this had been thought necessary at the time of the evaluation process. A brief description of the most significant studies and their conclusions is given below. The studies are grouped into four general areas, namely, physical environment, engineering, socio-economic analyses and evaluation of the project.

A. Physical environment

1. Bathometry and cartography

9. The 1:5000 bathometric maps available since 1992 which cover the areas of the two possible routes were judged to be remarkable (E/1993/80, para. 17). They were considered quite adequate for the current stage of development of the project and it was therefore not thought necessary to undertake new bathometric surveys during 1993-1994.

10. Meanwhile, a new 1:25000 map of the strait which follows the sectioning and unique referencing system adopted by the Instituto Geográfico Nacional in Madrid and the Division de la Cartographie in Rabat has been completed, and the entire set of 7+7 sheets corresponding to the Spanish and Moroccan coastlines has been made available. It is planned to include bathometry in subsequent editions of the map.

2. Geotechnical studies

11. As recommended by the evaluation report (E/1993/80, paras. 21 and 31), priority was given to the galleries and shafts designed for geotechnical studies on both sides of the Mediterranean.

12. October 1993 saw the completion on the north side of the experimental shaft at Bolonia which, at 74 m deep and 3.3 m in diameter, is primarily intended to yield information about one of the most resistive rock formations in the vicinity of the strait. A number of behaviour parameters of the ground and its effect on the lining were systematically monitored until the end of 1993 using 35 measuring locations; two separate measuring surveys were conducted, one in March and the other in September 1994. The results, which were judged favourable, are being digested and extrapolated in the context of other studies relating to the project.

13. The construction of the experimental gallery at Tarifa, which had been on hold since 1992, was begun in 1994 and is currently at the tunnelling stage. The Tarifa gallery, which is also located on the north side, is a 700-metre-long blind tunnel with a diameter of 3.8 m and 70 m of average overburden; its purpose is to determine the geotechnical characteristics and observe the geomechanical behaviour of a set of geological formations which are considered extremely typical of the project zone. To this end, the gallery contains approximately 80 monitoring locations designed to measure parameters such as convergence, the pressure exerted by the ground on the lining, and the circumferential deformation of the lining with respect to two sections of the tunnel bore.

14. The Malabata experimental shaft located on the south side has been used to conduct various geotechnical experiments and investigations for a number of years. It is a 160 m vertical shaft - the planned depth of the tunnel at this location - with an internal diameter of 2.5 m, supplemented by a system of horizontal galleries of different lengths totalling 180 m which radiate from the bottom of the shaft and have been tunnelled under the seabed. The Malabata

shaft has made possible the study of the geotechnical characteristics and suitability for tunnelling of the various flysch units located in the project area which will reputedly prove resistive during the construction of the tunnel. An additional project involving the deepening of the tunnel to 313 m - equivalent to the lowest point of the tunnel crossing - and the construction at that depth of a gallery approximately 30 m long is currently under consideration.

15. These three projects have made it possible to make a highly accurate study of the geotechnical behaviour of certain formations that present special problems for the project. Although the results of the monitoring are still being interpreted, it can already be said that the ground studied is, in general, conducive to tunnelling by the tunnel-boring machine (TBM), from the stand-point of both impermeability and geomechanical behaviour.

3. Geophysics/seabed sampling

16. The Rift-Argus survey, whose purpose was the de visu exploration and video survey of the bottom of the sill of the strait from a submersible vehicle, was conducted from 5 August to 16 September 1994. The survey made it possible to view the deepest areas of the strait and confirm that at these depths the flysch units are found below the seabed and are covered almost entirely with a recent thin layer of sediment.

17. The so-called GC-94 survey was carried out from 5 to 13 November 1994 with a view to bringing the density of the sampling from the area of the path in the northern platform up to the level of the density of the representative sampling from the southern platform. The survey obtained 510 samples, including 155 flysch units and 355 recent sediments, which made it possible to increase the number of available seabed samples by 37 per cent, bringing the total to 1,866.

4. Offshore drilling

18. Offshore drilling is another activity to which the evaluation report recommended that the highest priority should be given, since such drilling is crucial to the current phase of studies. Knowledge of the thickness of recent sediments in the deep area of the sill and the study of the geological pillars with respect to depth at certain specific points of the path are decisive, indeed indispensable, factors in the final determination of the feasibility of the tunnel option. However, the specific difficulties that the strait's currents pose for offshore-drilling technologies, either by underwater drills or by drilling boats, make it necessary to undertake such surveys with considerable technological uncertainty.

19. Thus, the Short Drilling Survey 94, which was designed to carry out 50 drillings up to 5 m into the "sill route", conducted only about 30 drillings and on average penetrated to a depth of only 2.4 m, with an average net recovery of around 60 per cent. From a geological point of view, the drillings that were conducted on the platforms (at a depth of about 50 m) generally came across

flysch units, while all those carried out in the deepest areas remained in Plio-Quaternary strata.

20. After long preparation, the Deep Drilling Survey 94, which was to carry out eight deep drillings in the sill of the strait, situated at points considered critical or of special interest in the path of the tunnel option, finally got under way in January 1995. These drillings total 1,120 m of penetration, approximately two thirds to be carried out by destructive drilling and one third by core drilling.

21. The partial results obtained from the short and deep borings that have been carried out so far lead one to think, pending confirmation by definitive results, that the Plio-Quaternary strata, which are recent and highly permeable formations, would be superficial and would not jeopardize the construction of the tunnel.

5. Geological and physiographical studies

22. The neotectonic study of the strait, the purpose of which was to determine the deformations in the structural orogeny (after the middle Miocene) in order to contribute to the evaluation of tectonic stability in the area of the project, was carried out between February 1993 and January 1994 on the north side. The main conclusion of the study is that the area studied (approximately between 5° 14' and 6° 05' meridians) has been highly stable since the Pliocene, but at the same time presenting a limited area of relative high elevation between Tarifa and Punta Canales, where the coast underwent a relative heightening since the Oudjian period (100,000 years) estimated at 20 m, which represents a relatively modest rate of elevation on the order of 0.2 mm a year. The corresponding study of the south side has been in progress since June 1993. There are plans to hold meetings between those taking part in the studies of the two sides in order to harmonize methodologies and later combine the two studies into a composite report on the strait and, in particular, the area of the project.

23. The studies of other projects involving flysch units, also recommended by the evaluation study, have resulted in two types of relatively independent activities, namely, the collection of data concerning a group of projects of interest in the Mediterranean basin (Spain, Italy, Greece, Morocco, Algeria, Tunisia) and the participation of the companies in the monitoring during the construction of the Guadiaro-Majaceite hydraulic tunnel (5 m wide, 12 km long), particularly in its section of approximately 5 km in Numidian flysch.

24. The 1988 geological map of the north side is currently being updated. The updating involves, inter alia, the revision of the structural elements (faults, folds, contacts between layers and so on), which will no doubt lead to certain changes in, and new ideas about, the tectonic interpretation of the region. This work, whose progress depends on the availability of specialized teams, is concentrated in the area of the Bolonia arc, which is of particular importance to the project. The geological map of the south side is also being updated.

25. A dating study of the coral formations found in the deepest areas of the strait was begun with a view to determining, in the initial stage, the absolute age of seven samples of coral formation covering the areas of the sill, selected from among the core samples obtained during the Short Drilling Survey 94. The carbon-14 dating of these sediments is of great interest for the project, since it contributes to the assessment of the importance of these coral deposits in which - or near which - tunnelling would not be technically viable owing to their high degree of permeability. So far, results have been obtained on four core samples taken at a depth of approximately 250 m. The results show that the oldest corals analysed are about 30,000 years old. The coral formation in question is therefore relatively recent, falling between the last glaciation (Würms) and - as the presence of living corals demonstrate - modern times. Consequently, any hypothesis attributing the presence of these formations in the deepest areas of the strait to recent tectonic phenomena should be rejected. On the other hand, although pending confirmation, the dating suggests that the thickness of the formations in question is limited and would not affect the feasibility of the tunnel option at a depth of 400 m.

B. Engineering

26. As considered advisable in the evaluation report (E/1993/80, para. 82), the studies concerning the bridge and tunnel alternatives have been continued in parallel.

1. Bridge studies

27. The preliminary pilot project for the bridge solution has been drawn up. The bridge option, developed on the basis of an earlier descriptive study, constitutes the basic "bridge on fixed bearings" type solution favoured by the companies at the current stage of the studies. The solution proposed in the bridge pilot project follows an alignment 27.40 km long almost exactly north-south on the sill of the strait. It consists essentially of two very different parts: on the one hand, a main bridge, 13.65 km long, crossing the deep part of the sill, and on the other, two offshore access viaducts with a total length of 13.75 km linking the Moroccan and Spanish shores to the main bridge. These viaducts consist of 300 m mixed concrete-steel spans supported on piers founded in the seabed to a depth of about 55 m. The main bridge is a suspension bridge comprising three 3,550 m central spans and two 1,500 m side spans allowing 80 m headroom and placed in such a way that the two channels of the maritime traffic separation scheme in the strait would pass under the main side spans. The general characteristics of this bridge are as follows:

(a) The substructure consists of two anchorage pillars founded at a water depth of about 60 m and four gravity base concrete tetrapod piers, resistant to collisions by ships, founded at depths of 140, 315, 280 and 230 m (north-south), the design of which is based on that of large concrete petroleum platforms, as regards both structural aspects and construction methods;

(b) The superstructure, directly supported by the offshore piers, consists of:

(i) Four rigid "A"-shaped pylons - unusual in conventional suspension bridges - rising 480 m above sea level;

(ii) A conventional suspension system, in principle with two 1.07 m diameter carrying cables;

(iii) A twin-deck girder with a total width of 55 m, including 28 m air, incorporating cross bars spaced every 26 m at right angles to the suspension rods.

28. The construction cost of the "Bridge 28" solution has been estimated at about 8.7 billion European currency units (ECUs) (1994) and the construction time at about 19 years, including 4 years of additional studies. The internal rate of return would be about 5 per cent on the capital invested, for start-up in about 2015.

29. The so-called "Bridge 14" solution, crossing the canyon of the strait, has been studied briefly under the contract relating to the bridge pilot project. This "super suspension bridge" consists of: (a) a superstructure comprising two 5 km main spans, two 2.5 km side spans and three pylons rising 646 m above sealevel; (b) a substructure comprising three offshore piers founded at water depths of 95, 480 and 415 m respectively and two end anchorages, one on the Spanish side, in the vicinity of Punta Canales, and the other on the Moroccan side, near Ras Cirès. Although the study of this "superbridge" has been made only on the basis of principles extrapolating the outline and results from the calculations relating to the bridge on the sill of the strait - and therefore without wind tunnel tests - in order for it to be technically feasible only relatively modest technological extrapolations may be needed compared to the "sill" solution.

2. Tunnel studies

30. The preliminary pilot project for the tunnel option, work on which began in early March 1994, is at the stage of the preparation of the final report, a draft of which was presented in December 1994. The structure proposed in the tunnel pilot project is of the "Channel Tunnel" type. With a length between terminals of 42.5 km, it can accommodate regular passenger and freight rail traffic and also motorway traffic, tourism and heavy cargoes, transported roll-on-roll-off on rail shuttle trains. The general characteristics of the structure are as follows:

(a) The longitudinal profile of the structure is a total length of 38.7 km including 27.7 km under the sea, with a maximum gradient of 25:1,000, which would make it possible for the alignment to go to a point 400 m below sealevel, thereby ensuring a minimum ground cover of 100 m at the deepest point where the water depth is 300 m;

(b) The transverse section consists of three galleries: two rail tunnels with a single track 7.5 m in diameter, about 60 m apart, and one service tunnel 4.8 m in diameter, situated midway between the other two tunnels and linked to them by transverse tunnels 3 m in diameter and 340 m apart.

The pilot project includes not only the basic study on the operation of the transport system which is the proposed solution, but also a description of all fixed and movable equipment.

31. One important characteristic of the "tunnel" option which is strongly emphasized in the pilot project is the possibility of building the structure in two stages. The first stage consists of the first rail tunnel and the service tunnel. The second stage supplements the first stage by adding the second rail tunnel. This possibility of carrying out the work in two stages is of great interest from the point of view of the economic feasibility of the project since it provides for a very significant staggering of costs, while ensuring, over a period estimated at 20 to 25 years, a capacity adapted to estimates of traffic requirements, with an acceptable level of service.

32. The conclusions of the preliminary pilot project call for the construction, first, of the undersea section (28 km) of the service tunnel as a reconnaissance gallery, with the dual objective of avoiding all geological and geotechnical hazards in later stages of construction and thereby reducing costs, while minimizing risks by taking advantage of the experience acquired.

33. Thus, based on these conclusions, the preliminary pilot project presents a timetable and cost estimates for three phases of the development of the project, namely, phase 0, construction of the reconnaissance gallery; phase 1, construction of the first rail tunnel and the first stage of the terminals for the operation of the single-track project; and lastly, phase 2, where two-track operations would be introduced through the construction of the second tunnel and the second stage of the terminals. According to this schedule, if all goes as currently planned, the suggested timetable is approximately as follows:

Phase 0: 1997-2002. Construction of the reconnaissance gallery.

Phase 1: 2003-2009. Construction of the first rail tunnel and the first stage of the terminals. Opening of the single-track tunnel: 2010

Phase 2: 2025-2030. Construction of the second rail tunnel and second stage of terminals. Opening of the second tunnel: 2030

34. The cost estimates proposed by the consultant are shown in the summary table below:

Summary of estimated project costs

(in millions of ECUs (MECU), tax- and customs-free, in October 1994 values)

Component	Phase 0	Phase 1	Phase 2	Total
Underground structures	347	659	547	1 553
Terminals	-	217	20	237
Equipment	-	613	414	1 027
Rolling stock (utilized in phase 1)		237	-	237
TOTAL	347	1 726 a/	981	3 054
Additional rolling stock				
purchased during single-track phase				129
purchased during dual-track phase				344
OVERALL TOTAL				3 527

a/ The cost of phase 1 assumes that phase 0 has been completed.

35. A different consultant conducted a study parallel to the preliminary pilot project for the tunnel concerning the programming and estimation of costs for the reconnaissance gallery. The study, which further analysed the costs of this project estimated earlier by the same consultant, generally confirmed the technical feasibility of the construction of the reconnaissance gallery using a tunnel boring machine, and submitted a brief analytical estimate of the costs and time required for its construction, by use of a "duration model" and a "cost model". The results obtained can be summarized as follows:

Scenario	Construction duration (months)	Construction cost (MECU)
Central	42	275
Adverse 1	62	290
Adverse 2	-	320

It should be noted that these cost estimates are significantly lower than the provisional estimates currently being provided by the preliminary pilot project for the tunnel, which foresees a construction period of 56 months and a cost of 347 MECUs (1 MECU = 1 million ECUs). This represents an increase of about one third over the above estimates for the main scenario, both in terms of duration and cost of construction. In the acceptance process during that study and the preliminary pilot project, the companies intend to study the comparisons further and thus to refine the estimates as far as possible.

C. Socio-economic studies

1. Socio-economic database

36. The socio-economic and Europe-Africa traffic database established in the companies' statistical services in 1992 has been significantly expanded by the introduction of a regional component, which should be completed by May 1995. This regional component of the database covers a territorial area on both shores of approximately 27,000 sq km and a population of 4.1 million, within which an area of approximately 6,000 sq km with a population of 1.4 million, where the project's influence would be most intense, can be differentiated. There are plans to complement and refine the information available, especially on the area known as the straits region, where the project is likely to have the greatest local impact.

2. Traffic forecasting

37. In order to update and structurally and statistically improve the model, known as Model 90, for estimating traffic in passengers and goods through the permanent link, as called for in the evaluation report (E/1993/80, paras. 52 and 53), a study to develop this model further was launched in January 1993. The results of this study, which was completed at the end of 1994, represent both the fine-tuning of an updated model - the SETEC 94 model - and the application of this model to a series of multiple variations on the basic hypothesis, in order to obtain predictions of traffic through the permanent link at two baseline horizons, 2005 and 2025. The main variables studied concerned (a) two types of permanent links, the basic "bridge" and "tunnel" options, respectively, and (b) two economic development scenarios, "trend-driven" and "sustained", essentially determined by the growth of the gross domestic product (GDP) in the European and African countries of the study area. The overall results of the forecasts are as follows:

	Passengers (millions; round-trip)		Goods (millions of tons; round-trip)	
	2005	2025	2005	2025
Diverted traffic	4.25	7.58	3.69	6.59
Engendered traffic	0.59	0.97	0.18	0.34
Created traffic	1.22	2.12	0.09	0.96
TOTAL	6.07	10.67	3.97	7.98

It should be noted that, as far as passengers are concerned, these forecasts are considerably lower (by about 40 per cent) than those previously obtained with Model 90. This important fact essentially results from the use in the latest study of a more precise model of the straits corridor, with its maritime shipping lines, which took better account of the competition those lines would offer to a permanent link, particularly the Algeciras-Ceuta route. The permanent link would take over only 57 per cent of the passenger traffic in the straits corridor, although, on the other hand, it would capture 95 per cent of traffic in goods (excluding bulk shipments).

38. In addition to this study, and in order to avoid the constraints arising from the fact that the model mentioned belongs to the consultant, a separate prediction model was also developed on the same general principles and the same statistical and forecasting basis as the other, although a different approach was taken to certain sub-models. The overall results obtained by the two models (evaluated without taking into account traffic created) were found to be consistent for the most part.

D. Project feasibility studies

1. Baseline studies

39. A project evaluation model is being developed by the internal services of the SECEG company. Currently, programming of the sub-models for economic and financial evaluation is under way, the latter using formats for the financial analysis of concessionaires that are in keeping with the accounting rules generally accepted in the European Union.

40. A study of the "no project" alternative was begun in November 1994 in order to contribute to the "benchmark" scenario, the situation if the project were not built. This study is attempting in particular to explore scenarios for the long-term development of the system of maritime ferries through the straits.

41. The updating of the economic analysis known as SETEC 90 conducted in 1990 by the consultant began in July 1994, and the draft of the final report was submitted to the companies in December 1994. The study mainly consists in applying the economic and financial evaluation methodologies used in the pre-feasibility study produced by SETEC-Economics in 1990 to the current definition of the project, expressed essentially by the alternative structures

defined by the preliminary pilot project, and to the traffic estimates resulting from the models recently developed.

42. The results contained in the final report, submitted in provisional form, are clearly negative for the bridge option - considered in the study exclusively for purposes of form - and clearly positive for the tunnel option, carried out in two phases, the first operating with a single tunnel. Indeed, whereas the estimated internal rate of return for start-up of the bridge in 2015 is 6.3 per cent, the estimated rate for the tunnel opening in 2010 is 14.3 per cent. The updated cash flow in 2010 of 9 per cent would be 5,400 MECUs (1993).

43. Still within the tunnel option, given a hypothetical financial arrangement such that the financial cost of the project, estimated at 4,655 MECUs, would be distributed as 33 per cent public funds, 20 per cent project capital and 47 per cent loans, the result would be an internal rate of return on its own capital of 21.6 per cent in nominal terms and 16.2 per cent in real terms, with an updated cash flow in 2010 of 9 per cent, or 10,700 MECUs (1993).

44. The above results correspond to a baseline definition of the project, which is currently undergoing minor adjustments with regard to the acceptance of the preliminary pilot project for the tunnel and models of traffic estimates. These adjustments affect, inter alia, construction costs and timetables, quite likely in the direction of greater feasibility. The final review of these elements is expected to be completed before the definitive acceptance of the studies in April 1995. Moreover, the economic study itself is undergoing final adjustments, from the point of view of both the methodology and the assumptions concerning the arrangements for the model concessionaire on which the financial analysis of the project is based. As before, it is expected that these readjustments will be finalized before the eventual acceptance of the economic study at the end of April 1995.

45. As part of the approval process for that study, the companies reviewed a series of alternatives for the financial analysis of the project, based on hypothetical institutional arrangements consisting essentially - in accordance with the technical principle of anticipating the construction of a reconnaissance gallery that would later comprise the undersea section of the service tunnel for the project - of financing the reconnaissance gallery entirely with public funds. Once it is built, it would be turned over at no charge to the concessionaire, which would then complete the construction of the project without any additional public financial assistance. The results obtained from these internal evaluations of the same hypotheses as in the consultant's provisional report, except where the financial arrangements referred to are concerned, are indicated in the table below. All the variations correspond to a timetable envisioning the beginning of the concession period (including construction of the project) in 2003 and the beginning of project operations in 2010.

Project capital as percentage of financial cost	Concession period in years	Nominal internal rate of return, in per cent	Real internal rate of return, in per cent	Updated cash flow (2020, 9 per cent) in MECU
20	30	21.15	17.06	3 978
20	40	21.87	17.75	6 677
30	30	18.60	14.59	3 823
30	40	19.49	15.45	6 529

2. Project evaluation study

46. The work programme of the companies includes the elaboration of a general project evaluation report in accordance with generally accepted standards for the evaluation of major transport infrastructure projects, including an economic and financial analysis and a brief assessment of the regional and environmental impact on the basis of the works contemplated in the preliminary tunnel pilot project and traffic estimates resulting from the new prediction models available. The terms of reference for this study are being prepared by the companies in two parts, dealing with the economic and financial analysis of the project and its regional and environmental impact respectively. It should be noted that these terms of reference are being prepared in such a way that they can also help to guide the end-of-phase report (feasibility report), which will be prepared by the companies with the cooperation of a group of independent experts, covering the most sensitive aspects of the project's feasibility, and, as necessary, with the help of technical teams from the research offices responsible for the baseline studies.

IV. OTHER ACTIVITIES

A. Public symposium on the permanent link (Cairo, 5 April 1994)

47. At the Annual General Assembly of the International Tunnelling Association (ITA), a public symposium on the project for a permanent link through the Strait of Gibraltar was held in Cairo on 5 April 1994 under the auspices of the Economic Commission for Europe and the Economic Commission for Africa. Participants in the symposium included the two regional commissions and the companies that conducted the studies, together with many officials and experts on tunnel building from Governments and private construction firms, including experts who played an important part in the building of the Channel Tunnel.

48. At the symposium, reports were presented on the main findings of numerous and diverse studies conducted in relation to the project for a permanent link through the Strait of Gibraltar, covering such topics as geology, geotechnical aspects, marine sciences, bridge and tunnel engineering, transport questions, economic and financial analyses and legal aspects, together with the principal findings of the 1993 evaluation of these studies by independent international experts.

49. Many speakers who had participated in either the planning or the building of the Channel Tunnel reported on the lessons learned, experience gained and difficulties faced, particularly during the execution phase of the project.

50. Against the backdrop of these lessons and experiences, a discussion was held at the symposium on the aspects which needed to be carefully studied in preparing a project for a permanent link through the Strait of Gibraltar in order to avoid any problems that might arise later during the construction if these aspects were not attentively and rigorously examined.

51. The best possible understanding of the geology of the seabed of the strait and the geotechnical nature of the rocks that would have to be perforated along the way was definitely considered crucial to a project of this scope, in order to reduce to a reasonable level the risks involved. To this end, studies now in progress on the geotechnical features of the rocks by means of on-site experimental galleries and shafts were deemed to be extremely useful. Offshore drilling in the deep areas of the strait to determine and confirm the presence of continuous flysch units across the entire strait and to determine the thickness of recent sediments were considered to be extremely important, if not crucial, to the final decision on the feasibility of the tunnel.

52. Besides these fundamental aspects, logistical problems and contractual issues were identified as areas which are often regarded as peripheral, and hence are not sufficiently taken into account in infrastructure works; they may, however, create major problems in the case of such large projects as the permanent link.

B. Fourth International Colloquium on the Permanent Link (Seville, 16-18 May 1995)

53. This Colloquium, initially scheduled for autumn 1994, was postponed to 16-18 May 1995. A brief report may be presented at the substantive session of the Council.

V. PROSPECTS FOR THE DEVELOPMENT OF THE PROJECT

54. The project for a permanent link through the Strait of Gibraltar is nearing a turning-point. While the studies conducted up until 1992 had enabled substantial progress to be made in understanding the essential aspects of the project and in establishing a reasonable, relatively sound basis for elaborating a project feasibility study, research in the period 1993-1994 essentially confirmed the earlier findings and produced further, more concrete results which represent important steps in the development of the project.

55. The preliminary pilot project for the tunnel option and the economic studies done in 1994 indeed pointed up the fact that, under the assumption that the reconnaissance gallery would be financed by public funds and then turned over free of charge to the concessionaire, which would then build the rest of the tunnel - a single tunnel in the first stage - without any additional public assistance, the capital invested by the concessionaire would yield an internal

rate of return comparable to that obtained in other infrastructure projects in both Spain and Morocco.

56. This tunnel option is feasible using existing, proven building techniques, will cause no harm to the marine environment, will make it possible to absorb both road and rail traffic, free of maritime navigation problems, and will meet funding imperatives; it therefore seems to be essentially the best solution in the current phase of study.

57. One fundamental aspect has yet to be addressed, i.e., consolidation of technical feasibility, which should benefit from the current off-shore drilling survey. The necessary government funds must also be found to build the undersea reconnaissance gallery; in that regard, substantial financial support from the European Union will be crucial. It is hoped that this support will be granted in the context of the European Union's Mediterranean policy, in view of the major role this tunnel will play in the land transport infrastructure network between Europe and Africa.

58. The evaluation report to be prepared by the companies at the end of the current phase of work, with the assistance of independent consultants, should put forward some proposals as to the following phase of work. If all other conditions are met, it will perhaps be time to take the decision to choose the tunnel option as outlined above.